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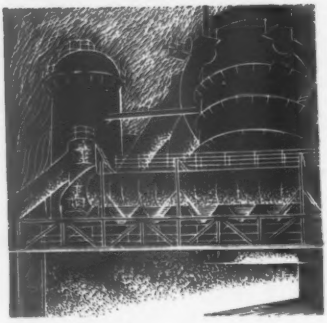

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FOUNDRY TRADE JOURNAL
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Vol. 71 Thursday, July 8, 1943 No. 1403

An Interim Report

The President of the Association of Bronze and Brass Founders, Mr. Henry Bissell, has issued to the members an exceptionally encouraging report covering the first half-year's activities. After outlining the membership growth, which has now banded together 87 of the largest producers of heavy non-ferrous castings in the country, the Report records the issue of a private report to the Industrial and Export Council on post-war trade, and an advanced stage in negotiations with the Board of Inland Revenue as to allowances in connection with the wear and tear of machinery. Shortly there is to be a report on the unification by the industry of conditions of sale, including the limitation of the period in which defective castings can be returned for free replacement. Questions of mutual interest have been discussed with other foundry organisations, both commercial and technical, for this association is both cognisant and appreciative of the latter activity. The section covered by a strong committee is presided over by Mr. George Hyslop. In its short existence the committee has collaborated with the Institute of British Foundrymen in the production of a fuel economy report, and in association with that body and the British Non-Ferrous Metal Research Association, reported to the Non-Ferrous Metals Control on Cast Brasses "A" and "B" (substitutes for gunmetal), and as a result the B.S.I. may be asked to modify the type "B" brass specification. A useful piece of work has been carried out in conjunction with the Federation of British Crucible Makers, whereupon the industry can anticipate in the not too distant future a return to that standard of excellence for which the British manufacturers were noted. The outstanding work, however, is that of standard costing. It was initiated by the chairman and his colleagues in the Phosphor Bronze Company. A report of outstanding merit was prepared and issued to the members, and a conference was held in Birmingham, to which not only members but the Costing Committee of the Institute of British Foundrymen were also invited. In the morning valuable contributions were made by the Phosphor Bronze Company's cost accountant, time study expert, the sales manager and the secretary, each telling exactly how the system of standard costing married with their particular activities. Later a general discussion was held, followed by demonstrations of the office machinery involved in its production. It cannot be too strongly emphasised that the installation and use of a reliable and intelligently operated costing system is fundamentally the best basis for employer co-operation, as it effectually prevents insensate competition; provides data for the relative economy of production methods; constitutes a safeguard against the fluctuation of the metal market, and makes for amicable co-operation with labour. To have a maximum beneficial effect, however, the system must be adopted by all firms constituting an industry. Its adoption squashes *ab initio* any criticism as to an association being a price-fixing ring, for unlike the establishment of a price list, the customer is made to pay for his purchases a price which is definitely related to the actual cost of production, and to this no man on the right side of an asylum wall can object, because firms showing the lowest manufacturing costs for any given article quote the lowest price.

American Non-Ferrous Founders' Society.—A Non-Ferrous Founders' Society was established in America last April among non-ferrous jobbing foundries whose principal output is in copper or copper base alloys. It is planned to provide this group with representation in Washington and with other government groups, and to keep its members informed of new developments in federal regulations.

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CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

SURFACE TOPOGRAPHY

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Your excellent and timely leader on "Surface Finish" is perhaps another reminder to foundrymen that we are entering an age when the user of castings—with science at his elbow—will be in a position to specify almost every conceivable quality or property which a casting possesses.

We have already travelled a long way from the not-so-far-off-days, when an order for iron castings went out with nothing more on it than the phrase . . . "to be of fine, close-grained iron, true to pattern and free from defects, blowholes, etc. . . ." or some such similar formula.

The array of testing methods and equipment necessary under present conditions is already considerable, and it is becoming a truism to say that the pure research methods of to-day are the routine tests of to-morrow. Admittedly, we have yet to see the electron microscope in the foundry, but no doubt it will come.

It should be no surprise, therefore, to see in print the suggestion that a qualitative and quantitative figure for surface finish may be added to the list of specified requirements in connection with the supply of castings.

The question of final surface finish is a vital one to manufacturers of precision parts for automobiles and aircraft, where the satisfactory functioning and freedom from excessive initial wear is governed largely by the initial degree of finish and fit obtainable. A considerable amount of research on surface finish has been carried out from this angle, and it is possible to obtain production finishes which vary less than one micro inch.

To assess a surface of this kind (which is almost optically perfect) one must have a delicate and expensive surface analyser, and here lies the crux of the matter. As you indicate, agreement has more or less been reached on the question of a standard specification; but before a standard can be issued and applied, every manufacturer must be in a position to measure and assess the surface he produces. At the moment there are probably under twenty surface analysers in this country capable of assessing surfaces down to 0.5 micro inch.

On the other hand, the Schmaltz optical section method, ingeniously adapted to a Vickers Projection Microscope and described by Mr. Kayser, is capable of dealing with surfaces having irregularities greater than about 20 micro inches, and this will adequately cover anything of the nature of an "as cast" surface. The method is simple and fairly easily applied, and could well be used as an aid to investigational work on the improvement of casting surface finish. Many sand and die castings (particularly light alloy castings) are used with the original "as cast" surface, and here again the method described could be usefully applied, in the first place by the founder to check the effect of mould or die dressings, and also by the ultimate user to ensure that a satisfactory finish is maintained.—I am, Sir, yours, etc.,

A. LOGAN.

Farnham Royal.
June 21, 1943.

A.S.T.M. PITTSBURGH MEETING

To provide ample time for presentation of the some 100 technical Papers and reports at the forty-sixth annual meeting of the American Society for Testing Materials held in Pittsburgh last week-end, 15 technical sessions were arranged. Outstanding sessions at the meeting covered corrosion; electrodeposited coating, and non-ferrous metals. As part of a series of discussions on significance of various tests in relation to design, a symposium on hardness testing was organised, Prof. J. M. Lessells, Massachusetts Institute of Technology, discussing "The Value of the Indentation Hardness Test"; S. R. Williams, Amherst College, "Present Types of Hardness Tests"; S. L. Hoyt, Battelle Memorial Institute, "Fundamentals of Hardness Testing"; and J. O. Almen, General Motors Research Laboratories, reading a Paper on "Some Limitations of Our Present Hardness Testing Methods."

One session featured reports of two A.S.T.M. committees: B-3 on Corrosion of Non-Ferrous Metals and Alloys and A-5 on Corrosion of Iron and Steel. Each year these committees report on latest inspection of country-wide exposure tests and occasionally evaluate the extensive data from these tests. This year Committee B-3 covered its ten-year tests of 24 non-ferrous metals, and Committee A-5 the results after six years' exposure tests on wire and wire products. In the non-ferrous session Papers on lead-alloy coated copper wire for electrical conductors: comparison of the performance of anodic coatings on aluminium alloys by salt spray test and by weather exposure: experiments on plastic bending for aluminium alloy 17S-7; conservation of tin and soft solders; and short-time tests of low-tin solders listed in recent Federal specifications, were presented. In addition to these items several A.S.T.M. committees reported on copper and copper alloys, cast and wrought; electrical heating and related alloys; and aluminium and magnesium and their alloys.

Canadian Nickel Expansion

International Nickel Company of Canada, Limited, has completed its $35,000,000 expansion programme, and has started up its enlarged production facilities. This expansion enables the company to handle a total of 35,000 tons of ore daily, and will add 25,000 tons of nickel to the 1940 total as well as about 37,500 tons of copper a year. As the result of the heavy demand for nickel and copper, International Nickel has been forced to draw heavily upon the high grade ore deposits from the Frood and Creighton mines, with the result that for peacetime production the company may have to depend largely upon its lower grade ores.

REPORT ON COPPER-ANTIMONY-NICKEL GEAR ALLOY

By MEMBERS OF THE NON-FERROUS SUB-COMMITTEE OF THE TECHNICAL COMMITTEE

Submitted to the Fortieth Annual Conference of the Institute of British Foundrymen

(Continued from page 182)

TIN-FREE GEAR BRONZE

By G. T. HYSLOP* (Member) and R. F. HUDSON* (Member)

Castability and Melting

Copper, nickel and antimony were ingotted in the following proportions: 7.5 per cent. antimony, 2.0 per cent. nickel, and 90.5 per cent. copper. Commercial antimony was used plus Monel bar end scrap (Si trace) and B.S. copper ingots; these were ingotted and the ingots used for all the following melts, together with returned heads and gates.

Sand, chill and centrifugal castings were all made. In the case of sand and centrifugal castings no trouble was observed, the metal being fluid and easy running, most of the castings being poured at about 1,200 deg. C. When the temperature was lowered to 1,150 deg. C. a skin appeared on the metal surface and the first traces of sluggishness were seen. The metal was clean, and top pouring was employed to ensure progressive solidification. In the case of the chill-cast sticks, minute gas or blowholes were present in all the small diameters, suggesting that the alloy solidified so rapidly that air and mould gases were trapped. This is perhaps one of the reasons for the low physical properties of this material shown in Table IV.

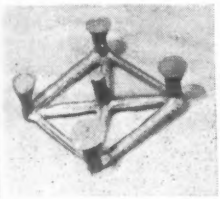


FIG. 8.—SHOWING METHOD OF CASTING TEST-PIECES.

The contraction of this alloy observed in green-sand castings was approximately 0.1 in. per ft. The castings had a good finish in green and dry sand, and no metal penetration occurred.

Both forced-draft and natural-draft furnaces were used in melting, and undoubtedly the best results were obtained from oil-fired and coke-fired forced-draft furnaces. No excessive oxidation or gas absorption occurred, and reasonable physical properties were maintained. On the other hand, when natural-draft coke-fired furnaces were used in conjunction with a slightly reducing atmosphere "spewing" occurred, the evolution of hydrogen forcing the molten metal to expand in the runner basin. Even when an oxidising flux (containing manganese dioxide) was used there was still no tendency for the heads to sink. Many of the alloy's characteristics were in marked similarity with 90/10 tin-bronze.

Physical Properties

Table IV shows the results obtained when cast in sand, statically chill cast and centrifugally cast. It will be observed that in contradiction to spun phosphor bronze the results of this alloy in comparison to sand castings give lower figures except in the case of density and Brinell hardness. Close agreement was found with the published test figures and also with the Hamilton Gear & Machine Company's statement regarding the lack of advantages associated with chill-cast gear blanks over sand cast. The photomicrographs indicate that chill and centrifugal castings have more, and also a finer distributed bearing constituent. (Blue coloured constituent most probably a beta solid solution.)

The Izod values, and in fact all the physical properties with the exception of yield point and Brinell hardness were found to be slightly lower than the equivalent copper-tin-phosphorus alloys. However, the figures shown are high enough to ensure a commercial value and use for this alloy.

The authors' firm is now trying out in service both sand and centrifugally cast gear wheels, and from these tests it is hoped to obtain valuable information. Some pressure castings were also manufactured (pipe castings with ¼-in. wall section), and these, on testing with compressed air, were found quite satisfactory at 100-lb. pressure.

Table IV gives the test results obtained co-related to analysis and pouring temperatures for sand, chill and spun castings. For comparison are given figures for a phosphor-bronze alloy. Fig. 8 illustrates the method used for making the sand-cast test-pieces, utilising a central downgate with four ingates running into risers at each end of the test-pieces (Eash pattern), producing two tensile test-bars and two Izod bars. The chill-cast bars were machined from a ½-in. dia. 2-ft. long cast stick, and the centrifugally-cast pieces cut from small gear blanks.

Micro-Structure

Fig. 9 to 13 show the micro-structure of sand and centrifugally cast copper-antimony-nickel alloy at various magnifications. Two phases are very prominent. Firstly, a cored structure is present similar to that in bronze, probably an alpha solid solution of copper-antimony and nickel. This phase at low magnifications has a light fawn appearance through which is dimly seen the cored structure.

The second main constituent is dispersed blue islands of a beta solid solution containing approximately 30-40

* Phosphor Bronze Company, Limited.

Report on Cu-Sb-Ni Gear Alloy

per cent. antimony, surrounded by the cored alpha solid solution. This beta phase is definitely the hard bearing constituent. Fig. 11 shows a centrifugally cast specimen with much more beta solid solution present, indicating better bearing properties with this method of casting. There are therefore all the attributes of a typical bearing alloy present, a fairly soft and yielding matrix included in which are isolated particles of a hard bearing compound.

Doubt arises regarding the presence of a third phase, as claimed by the originators of the alloy, but personal opinion is that this alloy contains only two. A third phase sometimes seems to be visible, but it is suggested that perhaps this is due to over-etching. The etching medium employed was the usual ferric chloride solution as used for brass and gunmetal. The beta solid solution (containing 30-40 per cent. antimony) also appears at the grain boundaries forming a eutectic solidifying at 640-650 deg. C. Black specks may be seen in this constituent, which are probably oxide inclusions. A report from Dr. W. T. Pell Walpole, of Birmingham University, on microstructure is appended.

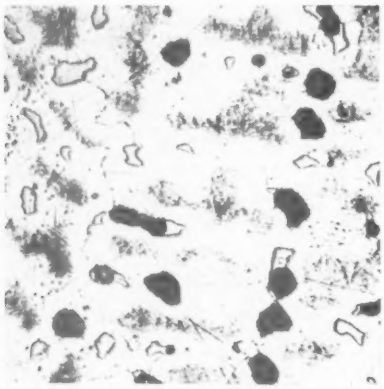


FIG. 9.—SAND-CAST TEST-PIECE, SHOWING BLUE CONSTITUENT OF BETA SOLID SOLUTION, CONTAINING APPROX. 30 TO 40 PER CENT. SB, SURROUNDED BY CORED ALPHA SOLID SOLUTION. (× 300.)

Due to the long freezing range of this alloy care must be taken to ensure rapid solidification in order to obtain good bearing properties and sound castings.

Machining is quite good, tools lasting a little longer than with tin-bronzes. This alloy is readily repaired by electric arc-welding methods using copper-tin flux covered electrodes. Several sand cast bushes were machined and subjected to a tinning operation with perfectly satisfactory results.

Further Tests on Tin-Free Gear Bronze

Other investigators having experienced trouble in the melting of this alloy, some casts were made to determine the correct method of avoiding gas absorption. As zinc prevents this in gunmetals it was decided to try a small addition of this metal, followed by deoxidation with phosphor copper. This treatment gave good results, and many heats have since been made from both oil-fired and natural draft coke-fired pit furnaces, resulting in gas-free castings, although oil-fired furnaces are preferred because of their uniform controlled atmosphere. Fig. 14 shows the appearance of a good head from a sand cast 2½ in. diameter solid bar following the use of this technique. The procedure is as follows:—

FIG. 10.—SAND-CAST TEST-PIECE, SIMILAR TO FIG. 9 (× 500). BOTH FIGS. 9 AND 10 SHOW SLIGHT TRACES OF POROSITY, THIS BEING DUE TO THE LONG FREEZING RANGE.

"Scrap or ingot metal is charged with 0.5 per cent. zinc; no flux is used, the metal being melted as quickly as possible in a slightly oxidising atmosphere. Immediately the metal reaches a heat slightly in excess of pouring temperature, it is withdrawn from the furnace and deoxidised with 0.05 per cent., P-Cu (10 per cent. P), the pouring temperature of the aforementioned casting being 1,180 deg. C. It has been found even with this method that "stewing" burns out the zinc and "gassing" tends to occur in such

TABLE IV.—*Mechanical Properties of Copper-Antimony-Nickel Alloy in Comparison with Phosphor Bronze*

Alloy.	Method of casting.	Density.	Yield point, tons per sq. in.	U.T.S. tons per sq. in.	Elong. per cent. on 2 in.	Brinell hardness No.	Izod ft.-lb.	Pouring temperature, °C.	Remarks.
Per cent.	Dry sand ..	8.16	11.2	14.7	9	69—82	3—5	1,160	—
	Green sand	8.17	10.5	13.3	5	—	3—5	1,200	Slightly segregated.
7.32 Sb	Chill ..	8.55	10.0*	10.5*	2	81—89	1.5 to 2.5	1,200	Fine grain.
1.80 Ni	Cent. ..	8.58	11.6	14.0	3	101	1—2	1,190	Vert. cast fine grain.
90.75 Cu		—	15.2	18.2	1	—	—	—	Horiz. cast fine grain.
11.05 Sn	Dry sand ..	8.37	10.0	17.2	12	85	4—6	1,100	—
0.28 P									
88.67 Cu	Cent. ..	8.71	12.2	19.8	10	105	—	1,140	—

* Average of three tests all bars slightly flawed.

TABLE V.—*Showing how Temperature and Furnace Atmosphere Affect the Mechanical Properties of Cu-Sb-Ni Alloy.*

Alloy.	Flux.	De-oxd.	Temperature of metal.	Pouring temperature.	Mechanical properties.			Furnace atmosphere gas analysis.		Appearance of head.
					Y.P. tons per sq. in.	U.T.S. tons per sq. in.	Elong. per cent.		Per cent.	
Per cent.										
7.5 Sb	None ..	0.05 per cent. P	1,220° C.	1,200° C.	10.2	13.6	7	CO_2	12.3	Sunk.
2.0 Ni								CO	0.7	
91.5 Cu								O	1.8	
								H	Nil	
								W.V.	0.0014	
									Per cent.	
Do.	None	0.05 per cent. P	1,300° C.	1,200° C.	9.7	11.2	5	CO_2	7.2	Spewed.
								CO	2.2	
								O	1.2	
								H	Nil	
								W.V.	0.0014	

The above results are obtained on materials made from ingots and scrap plus 0·5 per cent. Zn and melted in natural-draught coke-fired crucible furnaces

TABLE VI.—*Effect of Heat Treatment on the Mechanical Properties of Copper-Antimony-Nickel Alloy.*

No.	Alloy.	Heat treatment.	Mechanical properties.				
			Y.P. tons per sq. in.	U.T.S. tons per sq. in.	Elong. per cent.	Min. B.H. No.	Maximum B.H. No.
1	Sb-Ni-Cu Sand cast	None	11.45	13.5	7	70	80
2	Do.	3 hrs. at 450° C. Cooled in air	13.6	15.2	3.5	80	103
3	Do.	5 hrs. at 450° C. Cooled in air	—	—	—	85	—
4	Cent. cast	None	11.6	14.0	3	101	116
5	Do.	3 hrs. at 450° C. Cooled in air	14.8	15.7	2.5	114	143
6	Chill cast..	None	—	—	—	85	111
7	Do.	3 hrs. at 450° C. Cooled in air..	—	—	—	101	163

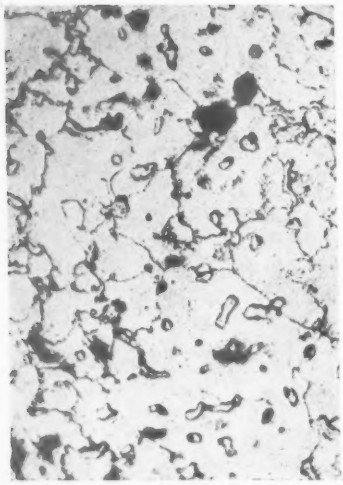


FIG. 11.—CENTRIFUGALLY-CAST TEST-PIECE, SHOWING SIMILAR STRUCTURE, BUT THE BLUE BETA CONSTITUENT BEING MUCH MORE FINELY DISTRIBUTED AND IN LARGER AMOUNTS (× 500).

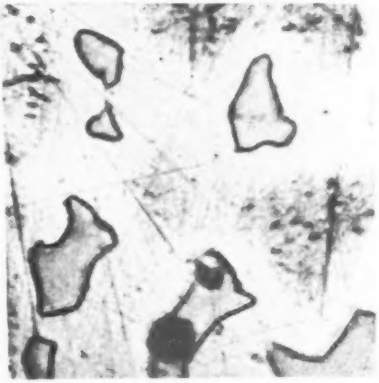


FIG. 12.—SAND-CAST TEST-PIECE, SHOWING BLUE ISLANDS OF BETA SOLID SOLUTION EMBEDDED IN ALPHA SOLUTION (× 1,000).

FIG. 13.—SAND-CAST TEST-PIECE, EXACTLY AS FIG. 12 BUT MORE DEEPLY ETCHED (× 1,000).

FIG. 14.—TYPICAL APPEARANCE OF FEEDING HEAD FROM GOOD CU-SB-NI ALLOY CASTING.

cases, especially in natural draft furnaces where the atmosphere tends to vary. This, as previously stated, is the reason why, wherever possible, the use of oil-fired forced draft furnaces is preferred. Up to date with this treatment 100 per cent. good castings have been obtained. Table V shows how excess temperature and a slightly less oxidising atmosphere alters the density and physical properties of this alloy."

TABLE VII.—*Showing Properties of Sand Cast Alloys of Modified Composition.*

Alloy.	Mechanical properties.					
	Y.P. tons per sq. in.	U.T.S. tons per sq. in.	Elong. per cent. on 2-in.	B.H. No.	Izod. Ft.-lbs.	Remarks
Per cent. 7.5 Sb 2.0 Zn 90.0 Cu	8.4	8.6	3	102	5	Segregated fracture.
8.0 Sb 92.0 Cu	9.6	11.6	5.5	99	4	Dendritic and segregated fracture

It was also considered that heat-treatment may have some effect on the properties of this alloy, and several tests were carried out on chill, centrifugal and sand-cast specimens in this direction. It was found that after heat-treating at 450 deg. C. there was an increase in both tensile and Brinell, with a reduction in elongation. The increase in hardness is interesting because of the possibility of this leading to an improvement in bearing characteristics. Service tests are accordingly under way on specimens in the "as cast" and heat-treated condition with the view of obtaining information in this direction. Table VI shows the effect of heat-treatment on the mechanical properties of the copper-antimony-nickel alloy in sand, chill and centrifugally cast condition. Fig. 15 shows photomicrographs of sand cast and heat-treated specimens at 500 magnifications.

Tests have also been conducted on alloys free from nickel, and it was found that this modification resulted in a considerable reduction in mechanical properties, as shown in Table VII.

This alloy appears to have favourable possibilities for the production of thin sectioned sand cast bearing bushes and gear blanks and for the manufacture of heavier sectioned gear blanks by the centrifugal process. The results of service tests are, however, required to confirm this statement. Further work is in progress to determine the physical properties of the alloy in the centrifugally cast condition.

Report on the Micro-Structure of an Alloy Containing 7.5 per cent. Antimony, 2.0 per cent. Nickel, balance Copper

BY DR. W. T. PELL WALPOLE

The microstructure consists of: (1) A heavily cored alpha (Cu-rich) solid solution varying in the etched condition from dark brown at the cores to pale straw at the boundaries; (2) pools of a second blue constituent (probably the beta of the Cu-Sb system with some Ni in solution) at the alpha boundaries. The beta is harder than the alpha, and presumably is intended to act as the usual "hard particle constituent" in the bearing. At high magnifications the beta has a marbled appearance, which probably indicates a partial completion of the reaction β-ϵ which

(*Continued on page* 203.)

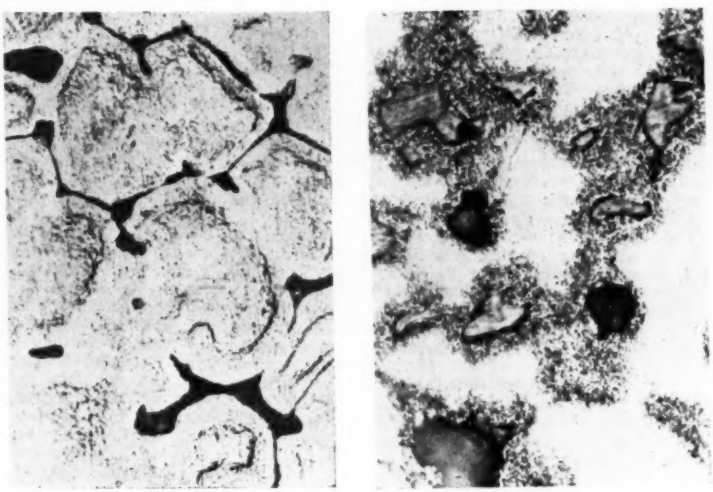


FIG. 15.—SHOWING THE EFFECT OF HEAT-TREATMENT ON THE MICROSTRUCTURE OF CU-SB-NI ALLOY.

SAND CAST (× 500). SAND CAST AND HEAT TREATED 3 HRS. AT 450 DEG. C., COOLED IN AIR (× 500).

BIRMINGHAM BRANCH REVIEWS A SUCCESSFUL YEAR

MR. SHEEHAN ELECTED PRESIDENT

The Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, under the presidency of Mr. T. H. Gameson, has been kept very much alive during the past year. Among the encouraging features on which the Hon. Secretary (Mr. A. A. Timmins) commented at the annual meeting, held at the James Watt Memorial Institute, Birmingham, on May 28, were that the membership has been strengthened, that the finances are satisfactory, and that interest in the work of the Branch has not been confined to a few prominent members. Mr. Gameson was in the chair at the opening of the proceedings.

The year's programme, the report stated, included five lectures of direct practical interest to all foundrymen. On an average, forty members were present at the meetings, an attendance of 65 being recorded at the lecture by Mr. A. E. Peace on "Pearlitic Malleable Cast Iron." The social side was not neglected, a dance arranged during May bringing together a company of 75 members and their ladies. The membership showed an increase, standing at the record figure for the Branch of 357, against 347 in the previous year. Sixteen new members were elected, and six were lost either by resignation or transfer to other Branches. Four members were serving with H.M. Forces. The new level reached by the membership entitled the Branch to four representatives, instead of three, on the General Council, of which it was proposed to take advantage. The Branch finances had been particularly good. The subscription income was a new record of £578 13s. 9d., and it was gratifying to note that at December 31, 1942, only ten subscriptions were owing. The report welcomed the increased interest shown by members in the activities of the Branch and the noticeable tendency for more members to take part in the proceedings. To Mr. Gameson was attributed, in no small measure, the credit for having stimulated the interest of the membership in general.

The report and financial statement were adopted.

Officers for the ensuing year were appointed, Mr. J. J. Sheehan, Senior Vice-President, succeeding Mr. Gameson as Branch-President. Mr. Sheehan was described by Mr. Gameson as a man of very marked ability who had had a very considerable experience in the foundry industry, both in this country and in other parts of the world. Mr. Gameson recalled that Mr. Sheehan was awarded the Oliver Stubbs Medal in 1941. Mr. N. C. Blythe and Mr. G. W. Brown spoke of Mr. Sheehan's qualifications for the office and of their expectations of a useful year's work during his presidency.

Mr. Sheehan, having taken the chair, returned thanks for his election and proposed for the office of Senior Vice-President Mr. G. R. Shotton. A member of the Technical Committee of the Institute, Mr. Shotton, he said, was paying particular attention to his own branch of the Institute, namely, the malleable cast iron section.

Mr. F. J. Cook (Past-President) seconded the proposition, which was warmly endorsed by the meeting. Mr. A. J. Shaw was elected Junior Vice-President.

Three vacancies on the Branch Council were filled by the reappointment of Mr. J. W. Gardom, and the election of Mr. B. Gale and Mr. H. G. Hall.

The following were appointed to serve as delegates to the General Council of the Institute: Mr. Shotton, Mr. L. W. Bolton, Mr. Blythe and Mr. Gameson. Mr. Bolton and Mr. Shotton were elected the representatives of the Branch on the Institute Technical Committee.

Mr. A. A. Timmins was asked, and consented, to continue to serve as Hon. Secretary and Treasurer, with Mr. H. Phillips as Assistant Secretary.

On the proposition of Mr. F. J. Cook, seconded by Mr. D. H. Wood, the officers of the Branch were cordially thanked for their services during the past year. Mr. Wood spoke of Mr. Gameson's successful efforts to promote the well-being of the Branch and also complimented Mr. Timmins on his work during his ninth year in the office of secretary.

REPORT ON Cu-Sb-Ni GEAR ALLOY

In the section on the analysis of copper alloys containing antimony and nickel, by R. Woollen, of Paper No. 768: Report on Copper-Antimony-Nickel Gear Alloy, by members of the Non-Ferrous Sub-Committee of the Technical Committee, preprinted for the recent annual conference of the Institute of British Foundrymen, an error was inadvertently made in the description of one of the reagents used. In the six references made in this section to "sodium thiosulphate," this should read "sodium hydrosulphite." This important correction should be carefully noted when using the analytical procedure described by the author. The captions of Figs. 1 and 2 should also be transposed both in the preprint and in the instalment of this Paper published in our last issue, and the note: "See Table III for Analyses" added as a footnote to Table II. In the preprint "P" should be inserted after 10 per cent. in line 7, second column, page 7.

Gas Surveys at Furnace Tops

Among the conclusions to be drawn from a survey of gas at blast-furnace tops, carried out by J. M. STAPLETON and described in an A.I.M.E. Paper, are: (1) Traverse gas samples indicate the effect on gas flow by material distribution in the furnace top. These samples may indicate corrective filling changes or even point to improvement in design; (2) furnaces operating efficiently have low carbon monoxide to dioxide ratios in the outer rings of the furnace top; (3) temperature readings are a guide to these ratios and may be substituted; (4) furnaces with similar dimensions and operating under like conditions but far apart in operating performance may sometimes be brought into line by some simple adjustment of which the nature may be determined by traverse gas sampling or temperature readings.

INSTITUTE OF BRITISH FOUNDRYMEN

PRESIDENTIAL ADDRESS

On his induction in the chair as President of the Institute of British Foundrymen, at the annual conference of June 26, MR. D. SHARPE delivered his presidential address on the subject of:—

"*Teach a man how to ask questions and you have given him the key to knowledge.*"

MAJOR MILES AND GENTLEMEN,

The foundry industry is a combination of science and art and the analytical mind which formulates questions goes a long way to answering them. It would be difficult to find a trade more prone to developing conundrums than the foundry industry. The lack of precision in moulding, melting and pouring castings calls for an individual deductance, often on the spur of the moment, which is found in few other lines of production. Decisions have to be made to meet the ever recurring emergencies, which if not acted on at once may mean scrapping valuable work.

During a man's normal lifetime in such a varied trade as metal founding, many changes in both theory and practice take place. Most of the changes are based on very small modifications which, when seen over a period of years, produce the appearance of major changes. Our present practice in even the most advanced foundries, has much in common with the old craft days, when a great deal of the work was done by individuals who had little opportunity of comparing their practice with that carried on in other similarly employed shops.

Thanks to the Institute of British Foundrymen, we have to a considerable extent changed this condition by providing lectures, discussions, works visits and association with a technical Press, which have done much to widen the experience of managers and workers alike. The education facilities offered to the young foundryman in all the varied branches of the trade have also been advanced, and we are hoping that even greater strides will be possible in the near future, thus inducing a good grade of youth to take up the foundry as a means of making a satisfactory living and an interesting career. The structure of the present foundry practice has a solid foundation on the records of the past, while the practice of the future is dependent on the performance of the present generation, that means you and me. We must treat this trust with great care if we are to produce a lasting prosperity for the generations to follow us.

Although we must take heed of the craftsmanship of yesterday, and to-day, it would be disastrous if the oft-championed claim for preserving the craft allowed us to ignore the greater claim of modern methods, which have done so much to improve the speed and economy of production, besides providing greatly improved working conditions both in comfort and safety, as compared with half a century ago. In dealing with this problem we must be both reticent and venturesome.

Changing Designs and Requirements

The foundry industry is under the great handicap, in the bulk of its manufactures, in not being the producer of a finished article. Most castings are designed and specified by some other branch of engineering, so that the finished product of the foundry becomes the raw material of the later process. Here is an opening for education outwith our own industry. We must give credit to many engineering firms for taking advantage of such knowledge as we pass on to them for modifying their designs to enable us to produce satisfactory castings.

The ever increasing up-grade in specifications, necessitated by changed requirements in strength, lightness, rigidity and exact dimensions, has made the foundry industry tighten up on all these factors. We are to-day asked to supply castings to tolerance of only a few thousands of an inch in dimensions, and to mechanical and chemical limits which call for metallurgical practice of a high standard. In dealing with these increased demands, the more advanced foundrymen have kept fully up with specifications, and it will not be long before many of the hit-and-miss methods of the past will be analysed by intelligent investigators when the rich experience of the old generation will form the basis of a general structure for substantial improvement.

In all these changes the symbol of our Institute is indicated "Science Hand in Hand with Labour." So long as we can advance together with science pointing the way to labour, we have much benefit to derive from the combination. If we can improve the quality of our output and at the same time sell at prices attractive to our customers, we should do something to make the life of the man-power in our foundries more attractive. I have been in foundries at home and abroad where working conditions were orderly, clean and labour-saving. I have been in other foundries, also at home and abroad, where conditions were repulsive in every detail. We must put the latter type out of action either by regulation or competition, as it is good for neither employer nor employee to live and work in such miserable conditions.

The first essential to improved working conditions is profitable trading, and much good will come of any scheme arranged to remove the pre-war attitude of some buyers of castings who squeeze founders to accept work at non-remunerative prices. Foundrymen who play into the hands of such buyers are doing a great disservice to the industry to which they belong.

Future in Specialisation

The future holds out great opportunities for specialisation where methods peculiarly suitable to the production of a distinct grade of casting can be introduced to reduce the cost of manufacture, and improve quality and accuracy, and I foresee steadily increasing efforts to travel along the specialist line. The mere introduction of mechanical plant into a foundry will not produce economic results, but the introduction of mechanical plant intelligently designed, laid out and controlled by highly skilled men, will work wonders in economy of labour, time and money.

The man behind the machine is much more valuable than the machine and it is the finding and training of such men that is our most important problem. If we can remove much of the drudgery from the skilled operative by the introduction of mechanical appliances, we can hope for a bigger flow of good labour into our shops. Much valuable time of a highly skilled moulder is employed doing work which raw labour could undertake successfully with mechanical plant under skilled supervision. I know of no trade offering better chances of improvement to an intelligent man than the foundry offers to-day. Such a man would want a wide education covering patternmaking, moulding, fettling, machinery maintenance and above all be production minded. Add metallurgical training and you have rounded off the major qualifications. "Are we producing many men of this type in British foundries to-day?" should be a pertinent question before the Educational Committee of this Institute.

The ever increasing mechanical aid has brought many engineers into the management of foundries, and, like it or not, I am afraid we must admit that this type of foundry manager is increasing because he has had a wider training than a man graduating from a patternmaking or moulding apprenticeship. I have observed many changes in practice during a period of 40 years and mention of some of the more important changes may be useful.

Thanks to the patient work of a number of men, we have developed quite a new technique in sand preparation. The international drive to find new and more consistent sand conditions has given us synthetic sands which at first hand may appear expensive, but when costed in relation to flowability, moulding speed, skin finish and reduced fettling often prove to be extremely economic. Mention should be made of the greatly improved sand mills, aerators and distributing conveyors. Mould facings have also been overhauled and we now have the call on many standard facings suitable to a wide variety of metals. Oil sand cores which were being developed by the steelfoundries about 35 years ago when such ingredients as molasses and sour beer were used have developed into one of the bright flowers in the foundry trade. Green-sand castings are now made where dry sand or loam was used when I was a youth.

Progress in Mechanisation

The introduction of power moulding has almost all been developed during my lifetime, and as I have been privileged to be in the forefront of the movement I may be permitted to say that we are still on the fringe of this development. Given a production demand justifying speeding up of patterns and machines, I am sure the moulding and core-making machine manufacturer will easily master the job.

Handling of materials in a foundry is a large part of the day's work and where intelligently applied and maintained the use of sand, mould and metal conveyors can reduce confusion, drudgery, fatigue and costs. Cleaning and fettling of castings has been greatly helped by modern methods. Metallurgical control of metal mixing, melting, annealing, heat-treatment and tempering are in the hands of intelligent advocates, and the improvement in quality justifies our confidence that when better metals are asked for, our metallurgists and melters will be ready to supply them. The accurate costing of each operation in a foundry, together with detailed data of production, has done much to unify selling prices and deserves all the attention that it is receiving.

The intensive conditions of production due to abnormal war demands will require to be carefully watched when the changeover to commercial life returns. Many factories are to-day working on types of casting which will not be required in peacetime and much forethought is being given to the change back to normal work. This should be a chance for the Institute of British Foundrymen to take a hand in straightening out many of the difficulties which are certain to develop and I feel sure that the services of our able Technical Committee will be of great value in helping members in peacetime as they have done in war.

I would like to pay a tribute to the capable way in which the equipment builders and material suppliers have helped in the gigantic developments occasioned by the increased demand for more and better castings. They have given the foundryman the tools and the foundryman has manfully done the job. We are not through with the war yet, but the efforts of all personnel of the foundry industry deserve well of the country for the way they have done their duty.

Vote of Thanks to President

MR. V. C. FAULKNER, proposing a vote of thanks to the President, said the address was a clarion call for action, and he was convinced that under the President's erudite and distinguished leadership all the various committees would work with added vigour knowing that they had his entire whole-hearted co-operation. His mind went back to the day during the last war when the President and he first met in Leven: the President as director of the steelfoundry and he as the metallurgist, putting into operation the electric furnaces which were being worked for the good of another war. This time they were all working in a much larger sphere for the prosecution of a still greater and bloodier war.

MR. J. G. PEARCE, who seconded the vote of thanks, said he could endorse the text of the presidential address, because on the technical and scientific side it was always felt that if it were possible to pose an accurate question, they were half-way towards finding the answer. The more difficult problem was often to ask the question in the first place. The Institute was to be very warmly congratulated on having elected Mr. Sharpe to the presidency, for he had a unique combination of experience both in the manufacture of castings and in the design and manufacture of equipment for their production. At this juncture in the history of the craft that would be very beneficial both to the Institute and to the industry.

The vote of thanks was heartily given.

A WARTIME STEEL FOUNDRY—SOME PROBLEMS AND DEVELOPMENTS

By E. D. WELLS (Member) and A. JOHNSON (Associate Member)

Presented at the Annual Conference of the Institute of British Foundrymen on June 26

Introduction

In presenting this Paper, the authors have drawn their subject matter from practical workshop experience over the last few years. During the war, particularly, they have had little opportunity for genuine research. The requirements of war production have meant that speed has become so much more important than before in the development of either a new material or a new method. Under more normal conditions time is available to confirm results at each stage of an experiment before progressing to the next, but during wartime it is very rarely that circumstances have permitted such a thorough but often lengthy procedure; thus in a foundry, tackle has often been specially prepared for a method which, though it may appear promising, is far from proved. It is in this atmosphere that the authors have worked since the outbreak of war, and, therefore, they feel that little apology is needed for the very general nature of the subject matter and for the lack of figures and definite data.

Very many admirable Papers are presented containing a wealth of facts obtained by skilled observers, but there is often something of a gap to bridge between the results as obtained under experimental conditions and those actually realised in the shops. It is felt, therefore, that some observations of a general nature on results obtained in the stress of wartime production may be of interest to many founders.

There is little doubt that the need for improving both the quality and quantity of output to meet wartime requirements has resulted in many practices being adopted that previously were considered impossible or at the least inadvisable. It is in one sense lamentable, but nevertheless quite true, that in more than one direction the effect of a war is to speed up development in several ways in all sciences and industries, and necessity has sometimes led to a better article being produced with poorer materials.

If in places the authors have departed from a statement of facts to comment on future development in the foundry industry, it is hoped that the fascination of such a subject will render its own apology.

Cupola Practice

The practice of melting a high percentage of steel scrap in the cupola became necessary early in the war, due to the shortage of hematite pig-iron and the (comparatively speaking) plentiful supply of scrap. At the authors' works, however, this practice had been the custom for many pre-war years for purely economic reasons resulting from their geographical position in the country. For many years 80 per cent. scrap and 20 per cent. pig-iron formed the standard cupola charge. The pig-iron contained 4 per cent. to 5 per cent. silicon, and the scrap generally was very good, a big proportion being tram rails cut into short lengths. This charge was melted in Poumay cupolas with a nominal "grey iron" output of 9 to 10 tons per hr. The rate of melting with this type of charge averaged over a long period 6½ to 7 tons per hr.

Long experience of the Poumay cupola has shown that whilst possessing some advantages in melting medium to large scrap, because of the pre-heating of the charge, when light scrap such as boiler plate parings is used in quantity, the oxidation becomes excessive and a troublesome, frothy slag is formed. The only way to control this is to try to induce less oxidising conditions by increasing the coke-metal ratio to somewhat uneconomic proportions in which melting coke may rise to over 20 per cent. of the metal melted and the rate of output be seriously reduced. From results obtained elsewhere there seems little doubt that for melting the smaller type of scrap in a high scrap charge a cupola with a single row of large tuyeres sited below the wind belt is a better type of furnace than the Poumay with its small main tuyeres and subsidiary tuyeres giving a pre-heating but sometimes heavily oxidising zone.

Reverting back to the cupola charge, early in the war a long trial was made with 90 per cent. steel scrap and 10 per cent. iron, the latter still being of the 4 per cent. to 5 per cent. silicon order. Very little difficulty was experienced during this period, but it must be said in all fairness that the quality of the scrap at that time was very high, both chemically and physically.

This type of charge gave about 0.7 per cent. silicon in the metal prior to blowing, and unless melting was rapid and the temperature kept high, some difficulty was experienced in desulphurising for which a fluid metal is most important. Accordingly it was felt that for a Poumay cupola this figure of 90 per cent. scrap represented the absolute maximum, and then only if the scrap itself is ideal.

This practice was discontinued when supplies of high silicon hematite became scarce and low silicon American pig-iron (1 to 1.3 per cent. silicon) was supplied. A reversion was then made to 80 per cent. scrap and 20 per cent. American pig-iron, but as the silicon in the resulting metal rarely reached 0.5 per cent., considerable difficulty was experienced in getting efficient desulphurisation. It therefore became necessary to add Fe-Si to the cupola, and in this connection it quickly became apparent that 45 per cent. grade

A Wartime Steel Foundry

Fe-Si was better for such a purpose than the 75 per cent. grade, for the reason that the larger bulk for a given silicon addition gave more uniform mixing in the metal. Furthermore, it became necessary to watch very carefully the size of lumps of Fe-Si added with each charge, since large lumps give very uneven silicon analyses due to concentration, whilst very small pieces were subject to heavy oxidation and even sometimes being thrown up the stack by the blast.

This practice was followed until a short time ago, when once again a quantity of 4 per cent. silicon hematite pig-iron became available, and it was then made possible to revert to the type of charge mentioned earlier, namely, 80 per cent. scrap and 20 per cent pig-iron, without any addition of Fe-Si to the cupola.

Experiments were made early in the war in melting 100 per cent. scrap in this type of cupola with and without Fe-Si additions, but in both cases a poor measure of desulphurisation was achieved, due to cold and/or sluggish metal. The resultant steel, moreover, even when omitting desulphurisation and tapping direct from cupola to convertor, was only fluid enough for heavy castings, and the needs of wartime production at the authors' foundry, involving a big proportion of light section castings, made this practice quite impossible, apart from the question of high sulphur content.

TABLE I.

	Old type lining.		Rammed dolomite lining.			
Blow						
1.. ..	0.049	0.052	0.038	0.036	0.037	0.032
2.. ..	0.049	0.047	0.036	0.037	0.034	0.037
3.. ..	0.037	0.039	0.034	0.032	0.038	0.036
4.. ..	0.038	0.042	0.033	0.034	0.042	0.039
5.. ..	0.037	0.044	0.032	0.036	0.041	0.038
6.. ..	0.046	0.051	0.043	0.034	0.040	0.040
7.. ..	0.040	0.050	0.032	0.036	0.040	0.036
8.. ..	0.053	0.048	0.034	0.032	0.037	0.037
9.. ..	0.054	0.047	0.035	0.040	0.038	0.036
10.. ..	0.040	0.046	0.038	0.038	0.032	0.038
11.. ..	0.047	0.044	0.030	0.032	0.036	0.038
12.. ..	0.045	0.050	0.032	0.034	0.037	0.037
13.. ..	0.051	0.051	0.036	0.038	0.032	0.035
14.. ..	0.054	0.046	0.040	0.037	0.030	0.034
15.. ..	0.054	0.042	0.041	0.032	0.032	0.038
16.. ..	0.048	0.046	0.033	0.036	0.038	0.036
17.. ..	0.051	0.047	0.036	0.038	0.041	0.032
18.. ..	0.045	0.043	0.037	0.041	0.036	0.038
19.. ..	0.048	0.044	0.034	0.040	0.036	—
20.. ..	0.048	—	0.036	—	—	—
Average ..	0.047	0.044	0.035	0.036	0.036	0.036
Highest ..	0.054	0.052	0.041	0.041	0.042	0.040
Lowest	0.037	0.039	0.030	0.032	0.030	0.032

Future of the Tropenas Process

Regarding the Tropenas process as a whole, the authors firmly believe that there are many developments still possible that will keep it well to the fore in steelmaking practices for many years to come. Its flexibility and its speed of production are still unrivalled by any other method of making steel, but there is still a somewhat variable set of characteristics obtained from successive Tropenas heats resulting from the varied state of oxidation reached at the end of each blow, and from the difficulties encountered in keeping phosphorus and sulphur low. The photo-electric system, spoken of occasionally as the "electric eye," about which the authors have heard little but hope a good deal, would appear to have great possibilities in removing some of the lack of uniformity in Tropenas steel-making caused by the reliance placed on the human element in judging the end of a "blow," and it is felt that full information on this subject would be welcomed by all the foundries employing the Tropenas process.

One of the most difficult problems in the Tropenas process is the control of phosphorus. A good deal can be done by careful scrap sorting, but, nevertheless, it is very difficult even in normal times to achieve regular figures below 0.05 per cent. At the present time the best solution, and the one adopted by many founders, is to run the acid Tropenas in conjunction with the basic electric process; thus are the speed and flexibility of the former married to the supreme quality and analytical accuracy of the latter.

Shortly prior to the war, the late Mr. Deschamps made a great effort to adapt the Perrin process of dephosphorisation of finished steel to cupola melted metal. The fear was expressed that dephosphorisation could not be effected in the presence of approximately 3.5 per cent. carbon since it was considered almost certain that the carbon would combine with the oxygen generated from the slag and intended for the oxidation of the iron phosphide prior to its combining with the lime in the slag. A visit was made to France for the express purpose of obtaining M. Perrin's views on this matter, and he expressed the opinion that it might nevertheless be possible to effect some measure of dephosphorisation in the presence of a large percentage of carbon. Experiments were accordingly made, but lacking at first an electric furnace for the fusion of the required slag, a trial was made with the slag in the unfused state. The trial was a failure, no visible reaction of any magnitude taking place, and there was no reduction of phosphorus.

The next experiment was made at Braintree with the kind agreement and co-operation of Messrs. Lake & Elliot. The slag was melted in the electric furnace and the cupola metal tapped on to it from a considerable height, as in the Perrin process for treating finished steel. A violent reaction started immediately and both slag and metal boiled out of the ladle. The dephosphorisation achieved was negligible, and it was agreed that the reaction was so dangerous and beyond control that no useful purpose would be served by continuing experiments on these lines.

Another development of the near future likely to lengthen the life of the Tropenas process is an improvement in desulphurisation arising from the employment of basic linings for the buckets in which the operation is carried out. A section is now devoted to reporting the progress made so far in the authors' foundry.

Desulphurisation in Basic Lined Ladles

A start was made over a year ago to determine what improvements could be effected by lining the bucket used for desulphurisation with some form of basic material. Hitherto practically every user of soda ash for removing sulphur from cupola iron has had his own method of lining the ladle used for this purpose, a big proportion of these linings being of an acid nature to a varying degree. In view of the strong basicity of soda ash, it is rather surprising that it has taken so long to develop a good reliable basic lining for this process, but experiments made so far, although not yet completed, suggest quite definitely that, with all other conditions unaltered, a basic lining gives a very definite increase in desulphurisation.

After consultation with Mr. N. L. Evans, of the Imperial Chemical Industries, Limited, and Mr. E. Shaw, of the Refractory Brick Company of England, Limited, who have shown very great interest in all the experiments, it was decided to try using stabilised dolomite in different forms.

Stabilised dolomite, its composition and manufacture, is fully described in the Journal of the Iron and Steel Institute by Swinden and Chesters. So far the material has been used as a lining rammed round a former, in the shape of unfired bricks, and also as fired bricks. Experiments are now in hand using unstabilised dolomite bonded with tar, but the results could not be obtained in time for publication.

For the first experiment the material was used in the ground state with water added to about 6 per cent. and rammed round a former. The lining was dried slowly, first with wood, then with partly-burnt coke, and was finally heated over a ladle fire prior to being used. After one day's use, during which some 70 tons of cupola iron were treated, very little damage was done to the lining, and the increase of capacity of the bucket was negligible. The improvement in desulphurisation, moreover, was very good—not only was the average figure lower, but there was much greater regularity. Some typical figures are given in Table I.

This lining was used for four successive days without any repairs being necessary, but towards the end of the fourth day the bucket was rapidly "gaining weight," finally holding nearly 4 tons instead of 3 tons as new. An attempt was accordingly made to patch the bucket, but the only material available was the same as that used for ramming and was decidedly "short" for the purpose. After patching and careful drying the ladle was again put into use, and after very few heats it became quite clear that the patching would soon all come away from the original lining. Further attempts to patch were made, but no matter how the procedure was changed, the results were always as bad. A repeat trial was made with a newly rammed lining and a similar set of results was obtained. The results at this stage were summarised roughly:—(1) Better average desulphurisation; (2) greater regularity; and (3) poor life, rendering the use of this material uneconomical.

In connection with (3), it must be pointed out that at this stage it is rather hard to state what is good economy in this respect and what is not. For instance, it is considered likely that most founders would be prepared for a rise in cost of liquid steel of a few shillings per ton if they could achieve a greater reduction of sulphur, since improvement in the quality of the steel and a greater freedom from hot tears is most likely to result, with corresponding economy at a later stage of manufacture.

Lining of Unfired and Fired Bricks

For the next experiment it was decided to try a lining of unfired bricks. As these bricks are moulded under great pressure and require very special moulds, it was not possible at the time to obtain the shapes desired. The bricks supplied were side arches and, being unfired, were of a crumbly nature. In spite of all precautions, therefore, it was not surprising that there were some bad joints in this lining, which, together with the fact that there were three to four times as many joints as would have been necessary if proper ladle tiles could have been used, gave the lining a short life. After only one day's use the lining was obviously failing badly, and although attempts were

A Wartime Steel Foundry

made again to patch the lining, the repaired portion would not adhere to the parent lining, and after only four days' use the whole lining was finished. The measure of desulphurisation reached, however, was remarkably good, giving very similar results to those obtained with the rammed lining.

For the third experiment we used bricks of a similar shape, but in the fired state. Very much better joints were obtained and, after careful drying, the ladle was put into use. Results obtained on 10 different occasions are given in Table II.

After these early troubles in patching had been reported to the suppliers, a new patching material was submitted. After the fifth day in the life of this particular lining, this material was used, and proved to be very much more workable than that previously supplied and stood up very well to a full day's use. Study of the figures above shows very distinctly that the results from the sixth day onwards were much poorer than those obtained when working on the original lining, so that, although a better material for patching has been produced, a falling off in the standard of desulphurisation is observed. At the present time no explanation can be found for this, so that the matter is still in a slightly unsatisfactory state.

As will be seen from comparing the latter figures in Table II with those obtained from the old type of slightly acid lining (see Table I), the results achieved by the patched dolomite lining are little better than those obtained from the old type of lining. It is regretted that no more up-to-date information can be offered on this matter, but the authors are confident that a little more time devoted to this problem will result in the attainment of a really satisfactory use of basic-lined ladles for desulphurising. It is quite possible that the experiments now being made with tar-bonded dolomite may prove to be a most satisfactory method, since it has been used in some works for several years for the transfer of metal from mixers to Bessemer converters, during which it is believed that the life of the lining is good and that a considerable measure of desulphurisation is carried out.

TABLE II

Blow										
1 ..	0.037	0.035	0.030	0.032	0.040	0.043	0.045	0.042	0.040	0.040
2 ..	0.035	0.034	0.032	0.037	0.037	0.040	0.047	0.043	0.037	0.042
3 ..	0.032	0.039	0.035	0.032	0.028	0.043	0.040	0.040	0.040	0.045
4 ..	0.033	0.036	0.030	0.037	0.026	0.044	0.039	0.044	0.039	0.045
5 ..	0.032	0.038	0.034	0.035	0.033	0.044	0.037	0.043	0.039	0.045
6 ..	0.043	0.035	0.034	0.030	0.029	0.042	0.042	0.040	0.036	0.036
7 ..	0.032	0.035	0.043	0.030	0.032	0.045	0.040	0.039	0.045	0.037
8 ..	0.032	0.030	0.031	0.038	0.035	0.045	0.039	0.041	0.039	0.036
9 ..	0.034	0.032	0.030	0.028	0.026	0.043	0.040	0.048	0.040	0.043
10 ..	0.035	0.030	0.032	0.026	0.038	0.040	0.042	—	0.038	0.040
11 ..	0.034	0.035	0.035	0.033	0.035	0.039	0.044	—	0.040	0.034
12 ..	0.034	0.035	0.033	0.030	0.032	0.045	0.043	—	0.040	0.037
13 ..	0.033	0.034	0.034	0.029	0.031	0.045	0.044	—	0.035	0.040
14 ..	0.039	0.034	0.037	0.030	0.030	0.052	0.045	—	0.040	0.039
15 ..	0.035	0.037	0.032	0.032	0.031	0.048	0.046	—	0.044	0.044
16 ..	0.030	0.036	0.030	0.031	0.030	0.045	0.039	—	0.045	—
17 ..	0.035	0.038	0.031	—	—	0.043	0.038	—	0.046	—
18 ..	0.037	0.033	0.030	—	—	0.043	—	—	0.047	—
19 ..	0.035	0.038	0.040	—	—	—	—	—	—	—
Average ..	0.035	0.035	0.033	0.032	0.032	0.044	0.042	0.042	0.041	0.040
Highest ..	0.043	0.039	0.043	0.038	0.040	0.052	0.047	0.048	0.047	0.045
Lowest ..	0.030	0.030	0.030	0.028	0.026	0.039	0.037	0.039	0.035	0.034

Whirl Gate Head

One of the greatest developments in steel castings in recent years is undoubtedly the introduction of the "whirl gate" head principle, which has been used for some years for certain non-ferrous work but has only recently been developed for steel castings. It is a great pleasure to take this opportunity of acknowledging the debt owed to Mr. R. L. Brown, Mr. Davenport and Mr. Speakes, of Messrs. Hopkinsons, Limited, for the pioneer work they have done in this respect and the freedom they have shown in disclosing the process to the industry.

A few of the more obvious advantages which are gained from this method are enumerated as follows:

(1) A great saving is made in the cost of oxy-acetylene burning and grinding, due to the better positioning of the heads and the small ingates which can be used.

(2) An increase in yield of casting from liquid steel can often be obtained by feeding 2, 3 or 4 small cast-

(*Continued on page* 204.)

MEEHANITE RESEARCH INSTITUTE

The eleventh annual general meeting of the Meehanite Research Institute was held last month in York. In the unavoidable absence of Mr. Oliver Smalley, O.B.E., the chairman, Mr. N. E. Rambush, vice-chairman, presided. He was supported by Mr. John Cameron and Mr. E. M. Currie, directors of International Meehanite Metal Company and Mr. R. B. Templeton, secretary and treasurer of the Institute.

There were more than 40 representatives of British licensees present. The chairman, in his opening remarks, reviewed the work of the Research Institute since its inception more than 10 years ago, and reminded members that they represented part of a world-wide organisation so that a good deal of the technical work originated in other countries, particularly America. In the early days of the British section they were able to contribute little to the general pool of information, but now they were contributing more and taking their full share in adding to the fund of information by original researches connected with the production and use of high-duty irons. Mr. Rambush extended a welcome to members of new licensees, who now total 21, and to new representatives of the older licensees and expressed the hope that they would take advantage of every facility which the Institute offered. In particular he reminded the new licensees that in the event of finding difficulties, they could write to any licensee or to the International Meehanite Office for assistance or advice, which would be very readily given.

MR. R. B. TEMPLETON, secretary, presented the annual report for the past year as well as the financial statement. Both were accepted as being very satisfactory. The financial statement showed that there was a considerable amount available for defraying the costs of essential research. The officers for the coming year were elected.

The meeting then resolved itself into the fourth wartime conference for the discussion of technical reports and Papers on a variety of subjects appertaining to the production of high-duty irons in general as well as some having special reference to the Meehanite process. The afternoon sessions were devoted to meetings of the Research and other committees. The Research Committee and its executive sub-committee reviewed the work which had been completed during the past year, or that still in progress and also drew up a programme of new researches to be put in hand during the coming year. The second day was devoted to further discussions on technical and business reports and Papers, concluding with a metallurgical session under the chairmanship of Mr. E. M. Currie.

During the conference discussions took place on a number of subjects pertinent to the production and use of Meehanite metal, including the use of British-produced substitutes for bentonite; study of micro and macro structures of Meehanite and their relation to physical properties and pouring temperature; resistance to attack by molten aluminium and its alloys; the production of Meehanite in rotary furnaces; the effect of heat-treatment on Meehanite; the replacement of brass and bronze by Meehanite; the high temperature testing of moulding and core sands; the possibilities of using hot blast in the cupola; the use of photo-elasticity and strain analysis as an aid to design; a study of galling, siezing and scruffing of metal surfaces and stress relieving.

There was also discussed a most comprehensive report on a system of quality control in Meehanite production. This report put forward a method by which the efficiency and consistency of control in any foundry could be numerically evaluated.

During a social meeting over which Mr. John Cameron presided, there was shown a film in Technicolor illustrating the Meehanite system of control and the high-speed machining of Meehanite castings in an American licensee's works. The depth of cut, feed and speed used in this establishment caused some astonishment to the meeting.

REPORT ON COPPER-ANTIMONY-NICKEL GEAR ALLOY

(*Continued from page* 195.)

occurs at about 450 deg. C. It should be noted also that with fairly deep etching the alpha develops a sub-boundary structure, which may give the impression that there are actually two yellow phases present. It is believed, however, that this is purely an etching effect. The whole structure is rather porous (pinhole shrinkage cavities), no doubt due to the very long freezing range (about 400 deg. C.). These features are shown in the photomicrographs taken at 300 and 1,000 magnifications respectively.

The above analysis is in accord with the interpretation of the constitutional system Cu-Sb-Ni, having regard to the lack of equilibrium due to the specimen being in the "as cast" condition. Copper and nickel are mutually soluble, each can dissolve (in equilibrium) about 8-9 of Sb, and with high Sb content each form a beta phase. Alloys containing less than 30-45 per cent. Sb will form (at high temperatures) only two phases alpha and beta. Both beta phases undergo transitions at lower temperatures. An alloy containing 7½ per cent. Sb, 2 per cent. Ni would, on equilibrium, be entirely alpha, but with normal rates of cooling should consist of heavily cored alpha with a certain amount of beta, which may be partially changed to ε during subsequent cooling.

The liquidus of the alloy is approximately 1,020 deg. C., the solidus approximately 650 deg. C.

(*To be continued.*)

Welding Technique.—A leaflet received from the Suffolk Ironfoundry of Stowmarket, Suffolk, is designed to show that the process for joining metals by "Sifbronze" is actually welding and not brazing. The argument is well developed and has at least convinced the reviewer as to its logic. Moreover, in setting out this comparison, a quantity of interesting technical data is disclosed.

A WARTIME STEEL FOUNDRY

(*Continued from page* 202.)

ings from one centrally placed whirl gate head. A head so placed forms a first-class reservoir of hot liquid steel, the very opposite to what was achieved by the older method of using many small heads, few of which fulfilled any useful purpose.

(3) By taking advantage of the temperature gradients of the steel, smaller heads may sometimes be used than is possible under the old system where a great mass of riser may be needed to counteract the fact that the hottest steel is near the runner—possibly at the bottom of the casting—and the coldest steel is in the head.

(4) Cleaner castings are produced through the whirling motion of the steel in the head keeping any sand washed in by the runner in the centre of the head and out of the casting.

It has been said that a greater height of head may often be necessary when the riser is on the side of the casting. This is following the belief that a certain height of steel is needed above the top of the casting to give the necessary pressure to feed the job. This height, which is taken as equal to the height of ordinary gravity heads—plus the depth of head down the side of the casting—would admittedly be excessive. However, the recent Paper given by Messrs. Taylor and Rominski on the use of atmospheric pressure in the making of steel castings successfully explodes this theory. As long as the top of a whirl gate head is kept open to the atmosphere, the height of the head need only be calculated in relation to the amount of feeding to be done, irrespective of its height above the top of the casting.

(*To be continued.*)

LIGHT METALS IN MANCHUKUO

During the past seven years the Japanese claim that the output of light metals in Manchukuo and the North China provinces has been considerably expanded under the Manchukuan second five-year plan, rendering Japan largely independent of imports, on which she previously relied exclusively. In 1933, large alumina-shale deposits were discovered, mainly in North China in the provinces of Fengtien, Jehol, Lungkiang, Kwantung and Chinchow. By 1941, total reserves were estimated at over 25 million tons, containing between 25 and 55 per cent. of alumina. The South Manchuria Railway Company built the first light metal works in Manchukuo, establishing a large research laboratory in Fushun. In 1936, the Manchuria Light Metals Company was formed, and later was absorbed by the Manchuria Industrial Development Corporation, associated with some of the principal Japanese and Manchurian concerns, notably the Nippon Mining Company and the Osaka Iron Works. Manchuria also has large magnesium deposits, said to contain on an average 45 to 48 per cent. of magnesite, the principal deposit being near Tashihchiao. To develop these deposits the Manchuria Magnesium Company was formed in 1938.

FUTURE MARKETS FOR TIN

The progress made in tin conservation is such that, if present economies can be maintained, consumption by the Allies will closely approximate to the supplies currently available to them. To that extent the more urgent problems of tin conservation may be said to be in process of solution. What will be the situation when world markets are again open? It is obvious that many of the altered procedures now adopted in industry have been accepted willingly only because they contribute to the war effort; but many modifications have entailed considerable trouble and expense, and such economies will be abandoned as soon as possible. Other economies have been effected by modifying designs or equipment, and in those cases varying periods may elapse before it is found expedient to revert to pre-shortage practices. In cases where truly successful substitution has been effected reversion to pre-war practice cannot be expected.

Making the above observations in No. 14 of their review, "Tin and its Uses," the Tin Research Institute remark on the mental attitude which may have developed as a result of the several years of propaganda in favour of substitutes for tin. The first impression created by a review of current technical literature is that in almost every field of use substitutes or alternatives are available which give superior service. A closer scrutiny, however, reveals that the superior qualities stressed are by no means all that enters into a judgment of all-round usefulness, says the review. The net result is an impression that temporary wartime expedients are achieving a degree of permanent elimination that is not confirmed by close contact with, and knowledge of, the industries concerned.

BARROW HÆMATITE STEEL CO.

The Hon. Robert James, presiding at the annual meeting of the Barrow Hæmatite Steel Company, Limited, stated that the assets remaining to the company, after the sale of its steelworks and hoop works, had been valued for war-damage insurance purposes at £1,413,023, as against a book value of £630,308.

Referring to the sale of the steelworks and mills to the Ministry of Supply, he said that they regretted severing their connection with an industry with which the company had long been associated, but they must remember that their steelworks and mills were old and to have modernised them completely would have involved a sum of money outside the reach of the company.

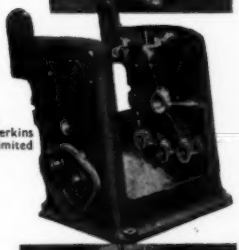
As a result of the deal, the company's liquid position was greatly strengthened. The debentures would, in due course, be repaid, and when accounts were finally squared up they would find themselves with no indebtedness and a substantial sum of cash available for further development of the company. The board's mind was clearly made up as to the direction these developments should take—developments which should make the utmost use of natural resources. In the meantime they continued to modernise and extend their quarry plant and activities.

STANTON DALE

Refined PIG IRON

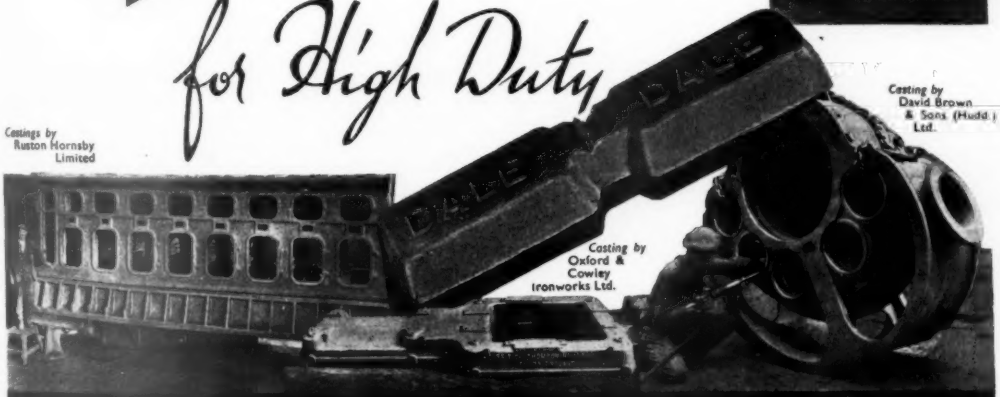
for High Duty

Castings by Morris Motors Limited.



Casting by Baker Perkins Limited

Castings by Ruston Hornsby Limited



Castings by Ruston Hornsby Limited

Casting by David Brown & Sons (Huddf.) Ltd.

Casting by Oxford & Cowley Ironworks Ltd.

THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM.

NEWS IN BRIEF

THE COST-OF-LIVING INDEX FIGURE on June 1 was 98 points above the level of July, 1914, as compared with 99 points a month earlier and 56 points at September, 1939.

GENERAL BRONZE CORPORATION has acquired Powder Metallurgy, Inc., of Long Island City, a pioneer in the field of producing metal products from raw materials in powder form.

THE AMALGAMATED ENGINEERING UNION has been directed by a delegate conference to ask the Government to provide for income-tax deductions being made on current weekly earnings.

THE BRITISH EMPLOYERS' CONFEDERATION has re-elected Lord Weir honorary president and Sir Harry F. Brand president. The three vice-presidents are Sir Charles Craven, Mr. Andrew K. McCosh, and Mr. Alan C. Macdiarmid.

AT THE REQUEST of the Minister of Aircraft Production Lord Aberconway, the chairman, and the board of Westland Aircraft, Limited, have agreed to place at the disposal of the Ministry of Aircraft Production the services of Mr. Eric Mensforth, the managing director of the company. Mr. Mensforth will act as chief production adviser to the chief executive. He will serve without remuneration.

THE JUNE ISSUE of the "Nickel Bulletin" contains abstracts of work dealing with the influence of alloy elements on nickel, the effect of nickel in bronze alloys, creep test data on nickel-chromium-molybdenum steels and the use of austenitic electrodes for welding chrome-molybdenum steel. Copies may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1. Individuals are requested to give the names of their firms or otherwise indicate the nature of their interest.

ENGINEERING APPRENTICES' WAGES

Under an agreement between the Engineering and Allied Employers' National Federation and the Confederation of Shipbuilding and Engineering Unions, the wages of apprentices, boys and youths in the engineering industry have been revised. The agreement, which is retrospective in effect from the beginning of the first full pay period after March 20 last, provides that the basic rates and bonus of apprentices, boys and youths shall be based on the appropriate district rate and national bonus of the fitter on the following percentage basis:—Age 14, 17½ per cent.; age 15, 22½ per cent.; age 16, 27½ per cent.; age 17, 32½ per cent.; age, 18, 45 per cent.; age 19, 52½ per cent.; age 20, 62½ per cent. In the case of pieceworkers, the appropriate national bonus will be based on the pieceworkers' national bonus. Piecework prices, bonus or basis times will be such as will enable a junior male worker of average ability to earn at least 27½ per cent. over time rates, excluding national bonus.

OBITUARY

MR. WALTER CATCHPOLE, managing director of the Maltby Metallic Brick Company, died recently.

MR. JAMES GOWANS, assistant plant engineer to Wm. Beardmore & Company, Limited, died at Paisley on June 23.

MR. ALEXANDER LIDDELL, managing director of John Hawthorn & Company, Limited, Canal Foundry, Newtown, New Mills, Stockport, Ches., died last week, aged 63 years.

MR. JAMES HUNTER LAMONT, chairman and late managing director of James H. Lamont & Company, Limited, engineers and founders, Corstorphine, Edinburgh, died on June 23.

MR. CHARLES VINCENT SALE, who recently resigned from the boards of the Amalgamated Metal Corporation, Limited, and its constituent companies owing to ill-health, has died at the age of 75.

MR. WILLIAM O'KEEFE died suddenly at Birmingham on June 27. He was one of the most popular members of the foundry equipment industry. "Bill," as he was universally known, was an Australian. He served his apprenticeship at the British Westinghouse Engineering & Manufacturing Company, Trafford Park, Manchester. He formed the Adaptable Moulding Machine Company, Limited, Birmingham, during the last war, and was successful in selling its products all over the world. Mr. O'Keefe was a great raconteur and was extremely popular in foundry circles.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

553,034 STEIN & COMPANY, LIMITED, J. G., HYSLOP, J. F., and MACKENZIE, R. Process for the production of alumina and magnesia.

553,082 WESTINGHOUSE ELECTRICAL INTERNATIONAL COMPANY. Control systems for associated dynamo-electric machines particularly applicable to rolling mill drives.

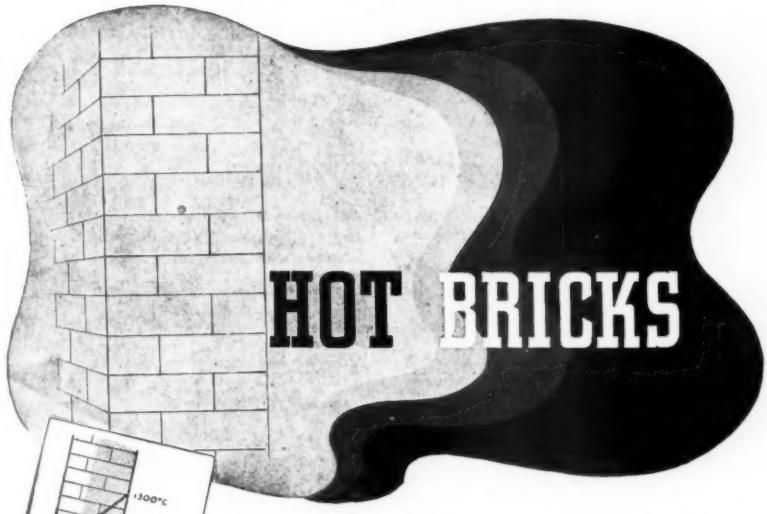
553,108 SHAW, H. Apparatus for determining the roughness of surfaces.

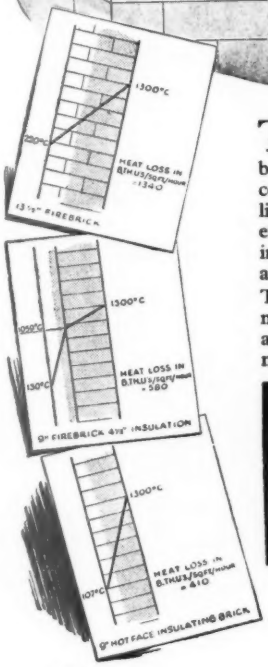
553,129 HARE & SON, LIMITED, C. H., and SNELSON, H. G. Means associated with presses for forming sheet-metal articles.

553,170-1 ARC MANUFACTURING COMPANY, LIMITED HAIM, G., and MCALLISTER, D. Manufacture of metal welding rods.

553,288 DETHERIDGE, H. T., and BILLINGTON, J. E. Couplings for rods, bars, tubes, and the like.

MR. GEORGE MACDONALD, Deputy Director of Armament Production in the Ministry of Aircraft Production, has been appointed to the post of Director. Mr. MacDonald is a director of E. Chalmers & Company, Limited, metal merchants, of Leith, and was lent by the firm to the Ministry of Aircraft Production.





THE heat absorbed and stored in a hot face insulating brick lining is only about 33% of that stored in a firebrick lining. As the fuel used in heating up a furnace is comparatively in inverse ratio to the heat stored in the lining, it is obvious that the use of hot face insulation must effect considerable fuel economy when heating up. In intermittent furnaces especially, the economies effected assume outstanding proportions.

The G.R. range of insulating bricks covers the requirements of every type of furnace. G.R. insulation specialists are at the service of users to advise on the selection of materials to suit particular conditions.

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HEAT-GENERATING PLANTS IN EVERY INDUSTRY WITH

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COMPANY NEWS

(Figures for previous year in brackets.)

Allied Ironfounders—Ordinary dividend of 12½% (same).

Peter Brotherhood—Net profit for the year to March 31, £60,410 (£60,387); dividend of 20% (same).

John Brown & Company—Net profit for the year to March 31, £365,854 (£374,804); dividend of 10%, tax free (same).

Partridge, Jones & John Paton—Profit for year to March 31 last, after tax, £99,438 (£72,790); dividend of 3½% (3½%), tax free.

Newman & Watson—Net profit for the year ended March 31 last, before charging income-tax and N.D.C., £13,094 (£13,594).

Electric Construction—Net profit for the year to March 31 last, before taxation, £118,201 (£97,966); dividend on the ordinary shares of 12½% (10%).

Revo Electric—Net profit, after tax, for the year to March 31 last, £72,638 (£54,317); final dividend of 10% and a bonus of 2½%, making 17½% (same).

Sentinel Waggon Works (1936)—Net profit for the year to July 31, £18,465 (£6,972); preference dividend, £2,700; to reserve, £15,000; forward, £12,766 (£12,001).

Chloride Electrical Storage—Net profit for the year to March 31 last, £289,806 (£306,398); ordinary dividend and bonus totalling 15% (same); forward, £163,258.

Whitehead Iron & Steel Company—Net profit for the year to March 31, £159,660 (£230,617); dividend of 20% (same); to general reserve, £75,000; forward, £43,136 (£36,860).

Anderston Foundry—Net profit, after tax, for the year to March 31 last, £8,530 (£6,939); dividend of 7½% (6½%); to reserve, £2,000 (£1,500); forward, £14,777 (£11,654).

J. W. Singer & Sons—Profit for the year ended January 31, after debenture interest and taxation, £9,943 (£4,327); preference dividend, £600; ordinary dividend of 10%, £1,114; forward, £16,258 (£8,028).

Siemens Bros. & Company—Profit for 1942, after taxation, £252,140; dividend on the 10% cumulative preference stock, £55,000; dividend of 7½% on the ordinary stock, £183,750; forward, £413,010 (£399,620).

Callender's Cable & Construction Company—Net profit for 1942, after depreciation and debenture interest, £451,031 (£313,372); ordinary dividend of 15% and a cash bonus of 5%, making 20% (15%); forward, £306,552 (£266,304).

Bradley & Foster—Trading profit for the year ended March 31, £44,258; taxation, including E.P.T., £29,024; to depreciation reserve, £2,763; to war contingencies reserve, £7,500; net profit, £12,471 (£12,297); ordinary dividend of 10%, plus a bonus of 2½% (same); forward, £13,032 (£12,864).

Morgan Crucible—Trading profit for the year ended March 31 last, including profits of subsidiary companies and after providing for depreciation, £775,762 (£536,812); miscellaneous income, £31,979 (£37,644); taxation, £623,800 (£400,025); dividend on the ordinary stock of 10% (same); forward, £1,059 (£266).

N. Greening & Sons—Profit for the year ended April 30, 1943, after provision for taxation and deferred repairs, £29,500 (£27,269); depreciation and obsolescence reserve, £10,000 (£8,000); general reserve, £5,000 (same); dividend on the ordinary shares of 7½% (same); forward, after preference dividend, £14,781 (£12,462).

Whessoe Foundry & Engineering—Trading profit for the year to March 31 last, £277,770; total, with interest and dividends received, etc., £278,304 (£183,479); depreciation, £8,847 (£7,234); welfare and provident funds, £2,739 (£2,425); staff bonus, £10,000 (£8,500); tax provision, £206,599 (£98,244); dividend of 4% (same); forward, £40,934.

Sanderson Bros. & Newbould—Trading profit for 1942, after providing for E.P.T., £68,388; A.R.P., £4,502; debenture and bank interest, £7,659; reserve for deferred repairs, £22,600; depreciation, £9,899; reserve for current income-tax, £11,606; preference dividend for year, £2,473; to taxation reserve for 1943-44, £27,300; dividend of 5% on the ordinary shares, £5,355 (same); forward, £23,074 (£47,280).

Ruston & Hornsby—Net profit for the year ended March 31 last, less reserve for excess profits tax, £312,121 (an increase of £21,107 over last year adjusted to comparable basis); debenture interest, etc., £17,125; income-tax, £139,656; pension reserve, £10,000; reserve for post-war contingencies, £25,000; to general reserve, £30,000; ordinary dividend of 12½% (same); preference dividend, £11,750; forward, £60,988 (£59,273).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Light Castings, 26, Spring Hill Road, Sheffield, 10—£2,000. J. G. Woodcock and L. Smith.

South Croydon Engineering Works, 445, Brighton Road, South Croydon, Surrey—£10,000. S. S. Sanders and W. Pitt.

Denton & Best & Samuel Swift—Rollers, forgers and tilters.—£1,000. C. A. Elliott, 12, Paradise Square, Sheffield, subscriber.

Grenfell Engineering Company, Grenfell Works, Grenfell Avenue, Romford, Essex—£3,000. H. C. Born and W. J. Evans.

William Sharp (Birmingham), 25, Thimble Mill Lane, Aston, Birmingham, 6—Steelworkers, ironfounders, etc. £500. H. E. Swain and D. E. Horton.

Powderloys—Manufacturers of and dealers in metal and plastic powders and materials to form the cutting portion of tools, etc. £10,000. Three directors to be appointed by A. C. Wickman, Limited, and two by Kleinwort, Sons & Company.

COMPAGNIE GENERALE DU DURALUMINIUM et du Cuivre has been formed in Paris, with a nominal capital of 200,000,000 fcs. Compagnie generale d'electro-metallurgie and Soc. du duraluminium et de l'aluminium have each subscribed half the capital. The new concern is to develop the production of non-ferrous metals, especially aluminium and copper.

Load Trucks of SCRAP to Capacity!

Don't crowd the lines
that feed the guns,
And get the Ports
and Convoys stuck.

But clear the way
to beat the Huns,
And make the most
of every Truck.

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Raw Material Markets

IRON AND STEEL

It is acknowledged all round that the war industries have been, and are being, well served by the iron and steel makers, who have had to overcome many difficulties since the outbreak of hostilities nearly four years ago. Shortage of certain raw materials brought about by fluctuating fortunes in battle has, from time to time, necessitated changes in methods of manufacture, but the industry has shown the utmost resource in coping with these situations and, generally speaking, any inconvenience caused to producers has been restricted to the minimum.

Government departments continue to exert considerable pressure on the heavy-engineering foundries, whose outputs are readily absorbed in contracts of a priority nature. In normal times these foundries utilise chiefly the better classes of iron, such as medium- and low-phosphorus and hematite irons, but they have been compelled to alter their methods, owing to the shortage of these qualities, the ore for the manufacture of which has to be imported. In their place refined pig-iron, high-phosphorus iron, steel scrap, etc., are being used, and the result has not been unsatisfactory, although, of course, a reversion to the normal procedure would be welcomed. With the prospect of shipments of iron ore from the Mediterranean ports being on a much larger scale in the future, hopes of additional supplies of the better-quality irons being made available are considerably increased.

The position of the light-foundry trade does not vary to any extent from week to week. Some time ago a halt was called in the measures introduced to concentrate the industry, but since then there has been no great accession of business, although by adjusting their plant to the production of heavier castings, a number of works have derived appreciable benefit. But until it is possible again to manufacture the normal supply of castings for building purposes, it is extremely unlikely that the light-foundry trade as a whole will be able to operate on a full-time basis.

Satisfactory outputs of coke for foundry use are being returned in most parts, with the result that consumers are buying up more than is required for their current needs. This provision against the future will be of considerable benefit later in the year, when supplies are more liable to fall out of schedule. Many buyers, of course, cannot accumulate stocks of any size owing to lack of space, but their short-period demands are being readily satisfied.

NON-FERROUS METALS

Post-war trading in non-ferrous metals is a topic which is being widely discussed in metal circles just now. Naturally there is a divergence of opinion and no one can be too dogmatic on the matter, as the final word, at any rate as far as the immediate post-war era is concerned, may be expected to come from the Government. The Non-Ferrous Metals Control, the body in whom is vested the authority of the Government, has, it is generally considered, fulfilled its function satisfactorily as a wartime measure, and it must be expected that this body will not be dissolved the day the peace is signed, nor will normal trading conditions be re-introduced immediately. Tin is likely to remain in short supply for a considerable time after the war, although it seems likely that other non-ferrous metals will be plentiful.

In order to meet wartime requirements, production of metals has been raised to maximum levels, even small high-cost properties being called upon to make their due contribution. Output of copper, for example, is now very large and it seems inevitable that there will be a surplus of metal for a lengthy period after the cessation of hostilities. In these circumstances it is probable that a certain amount of control will be needed in order to prevent the price of copper falling to unreasonably low levels.

Duties and tariffs on non-ferrous metals are other aspects of post-war trading which will have to be given much consideration. What, for instance, would be the position of the United States if large tonnages of foreign metal were to compete with domestic output? Before the war import duties were operative on foreign lead and zinc arriving in the United Kingdom, but Empire metal was excluded from these provisions and very large supplies were sent here from Empire sources. There are other factors to be decided also and it is not possible accurately to forecast Government policy in these matters.

A SOUTH-COUNTRY FIRM has acquired premises at Jarrow for the manufacture of foundry specialities.

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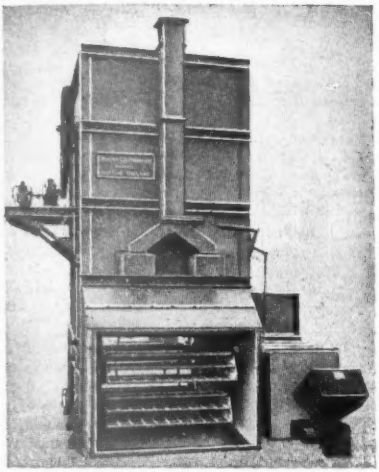

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Telegrams: "Sternoline, Phone, London"

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, July 7, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

Ferro-silicon (5-ton) lots.—25 per cent., £21 5s.; 45 per cent., £23 10s.; 75 per cent., £36 10s.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £44; max. 2 per cent. C, 1s. 0½d. lb.; max. 1 per cent. C, 1s. 1½d. lb.; max. 0.5 per cent. C, 1s. 1¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s. 6d.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20 × 14, 27s. 9d., f.o.t. 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 10s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11¾d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10¾d.; wire, 10¾d.; rolled metal, 10¼d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15¼d. per lb.; brazed tubes, 15¼d.; wire, 10d.

Phosphor Bronze.—Strip, 13¾d. per lb.; sheets to 10 w.g., 14¾d.; wire, 16d.; rods, 16d.; tubes, 21¼d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 15 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5¼d. to 1s. 11¼d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6¼d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9¼d. Wire round, to 10g., 1s. 7¼d. to 2s. 2¼d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6¼d. upwards.

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s., braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £74 10s., all per ton. ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended July 3, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

BRASS.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

CUPRO NICKEL.—80/20 cupro-nickel webbing, £75 10s.; 80/20 defective cups and envelopes before filling, £70 10s.

NICKEL SILVER.—Process and manufacturing scrap: 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

COPPER.—Sheet cuttings and webbing, untinned, £54; shell-band plate scrap, £56 10s.; copper turnings, £48.

IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus 3¾ per cent. dealers' remuneration. 50 tons and upwards over three months, 2s. 6d. extra.*)

South Wales.—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(NOTE.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*

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REGISTERED TRADE MARK
All grades FOUNDRY, HEMATITE SPECIALS, FERROSILICON, &c.
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ASSISTANT STEELFOUNDRY MANAGER (32) desires change; thorough practical and technical training; would consider any progressive position.—Box 924, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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Applications are invited for the following posts:—

ASSISTANT WORKS MANAGER (Metal and Steel Factory).

University degree or its equivalent, and a thorough grounding in either mechanical engineering or metallurgy. Experience in forging of heavy shell sections and heat-treatment of such forgings.

Salary: £840-£1,120 per annum. Reference ON.F. 607.

CHIEF METALLURGIST.

For ferrous and non-ferrous work at Metal and Steel Factory, Ishapore. Age about 35 years. University degree or equivalent diploma of recognised institute or technical college. Should have at least 5 years' practical works' experience, and have held assistant works manager or similar post for two years. Ability to control metallurgical processes on production scale, with experience in laboratory control. Knowledge of open-hearth steel making, heat-treatment and rolling. Knowledge of electric furnace processes an advantage. Ferrous work should cover iron and steel foundry. Experience in melting and casting of non-ferrous metals used in armament manufacture. Hot and cold rolling extrusion and cold drawing.

Salary £1,125-£1,485 per annum. Reference ON.F. 1002.

Applications, in writing, should be sent to the MINISTRY OF LABOUR AND NATIONAL SERVICE, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2, quoting the reference number concerned.

ACCIDENT PREVENTION.—Applications are invited from men, over military age or otherwise exempt, with considerable experience in industry, to investigate causes of accidents and to advise upon preventative measures.—Write, giving full particulars of past experience, also salary required, and state if, or when, free, to Box W.49304, HADDON'S, Salisbury Square, London, E.C.4.

TECHNICAL REPRESENTATIVE required; preferably knowledge and experience metallurgy iron castings.—Applications to Box 920, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

REPRESENTATIVE (exempt), Midlands area; preferably some knowledge furnace construction; to sell foundry equipment. State age, experience.—Box 914, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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AGENCY.—Advertiser, with excellent connections Non-Ferrous Foundries, Birmingham area, open to represent an additional first-class firm; own office and car.—Box 906, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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WANTED.—"Sprue" or "Gate" Cutter; to cut ⅜ in. sq. brass or gunmetal; punch type.—Box 928, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WANTED.—400 ft. of 18-in. ROLLER CONVEYOR; straight lengths.—Box 922, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WANTED.—Parkes or similar Testing Plant, with or without Compressor—Box 904, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

SINGLE CYLINDER Horizontal Air Compressor, INGERSOLL RAND, Serial No. 61799, Class E.R.1, 12 in. by 8 in. Fitted with mechanical Lubricator and Flywheels, 4 ft. by 6 in. by 9 in., at 250 r.p.m.; 260 cub. ft. displacement, 35 lbs. pressure. — NEWMAN INDUSTRIES, LIMITED, Yate, Bristol.

THOS. W. WARD LTD.

BABCOCK WATER-TUBE BOILER; 23,000 lbs. evaporation; 200 lbs. w.p. DITTO; approx. evaporation 10,000 lbs.; working pressure 150 lbs.

LANCASHIRE BOILER; 30 ft. by 7 ft. 6 in. by 180 lbs. w.p.

LANCASHIRE BOILER; 30 ft. by 8 ft. by 120 lbs. w.p.

Two LANCASHIRE BOILERS; 30 ft. by 8 ft. by 160 lbs. w.p.

Two LANCASHIRE BOILERS; 30 ft. by 9 ft. by 160 lbs. w.p.

LARGE AND VARIED STOCK GOOD SECONDHAND ROLLED STEEL JOISTS, ANGLES, CHANNELS, ROOF PRINCIPALS, ETC.

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FOR SALE.—Vertical, high-speed, belt-driven, water-cooled, single-acting, totally-enclosed type Air Compressor (Tilghman); 8½ in. by 10 in.; 400 r.p.m.; 100 cub. ft. displacement; 30 lbs. pressure; £95, on site.—EDWARD LUCAS & SON, Dronfield Foundry, near Sheffield.

IN STOCK.—60 in. by 48 in. OSBORN Turnover Pneumatic Machine; overhauled and in good working order.—ALEX. HAMMOND, 14, Australia Road, Slough.

HAND MOULDING MACHINES.

Farwell Type Plain Hand Squeezers.
Pickles Universal, turnover table 18 in. by 16 in.
Hand Squeeze Pin Lift, table 22½ in. by 14½ in.
Jackman Osborn Type 601 rollover Jolt Ram, table 30 in. long.
Samuelson Hand Ram, turnover table 24 in. by 19 in.
Berkshire Hand Ram Pattern Draw.
Pridmore Hand, to admit 15½ in. by 16½ in.
Sandblasting Plant; 50 Air Compressors; 500 Electric Motors, Dynamos, etc.

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JACKMAN Sandblast Table, 63-in. dia. complete and in good order, thoroughly reconditioned, in stock.—ALEX HAMMOND, 14, Australia Road, Slough.

MISCELLANEOUS

CAPACITY AVAILABLE FOR SMALL MANGANESE BRONZE CASTINGS. PROMPT DELIVERIES.—SEND YOUR ENQUIRIES TO WARWILL, LTD., ABERTILLERY, MON. 'PHONE 71.

A MIDLAND FOUNDRY with a limited capacity becoming available in the near future takes this opportunity of placing it at the disposal of firms requiring Non-Ferrous Castings in manganese bronze, aluminium gunmetals, phosphor bronze, etc. We would therefore welcome all inquiries and are confident that this would be of mutual assistance in the post-war period.—Box 918, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

ENGINEERS desire to contact Iron Founders in Midland area, which have capacity for quantity of iron castings from 10 lbs. up to 2 tons in weight.—Box 926, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MIDLAND FOUNDRY open to accept Orders for Castings up to 30 cwts.; plain or machined; green, dry sand, or loam. Good deliveries.—Box 902, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

CONTACT desired with Foundries having capacity for repetition work from 5 doz. to 5,000 in Grey Iron, High-Duty Iron, Meehanite, Malleable and Non-Ferrous Castings. Reasonable deliveries.—Box 912, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

PATTERNS for all branches of Engineering, for Hand or Machine Moulding.—FURMSTON & LAWLOR, Letchworth

YES, WE HAVE NO ORANGES . . .

But we keep our DATES. And we're booking NOW for 3rd week FEBRUARY, 1944.

Sorry, folks, boiler gone. And was it a bargain? Oh, boy!

We want Chimneys or Tubing, erected or dismantled; good prices paid.—ESERIN (STEEPLEJACKS), LTD., 7, Great Castle Street, W.1. Langham 2914.

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4' 6" Cupola by Pneulec as new.
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New 4ft. sandmill.

NEW SHOT BLAST CABINET PLANTS with motor driven Exhaust Fans, complete, all sizes; air compressors to suit in stock, also motors if required.

Alex. Hammond, *Foundry Machinery Merchant.*

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BUY FROM ME AND SAVE MONEY

MISCELLANEOUS—*contd.*

FOR IMMEDIATE DELIVERY TO IRON & STEEL FOUNDRIES SEND TO:—

JOHN & C. DURRANS,
Est. 1934,
PENNINE WORKS, HAZLEHEAD, NEAR SHEFFIELD.
Penistone 128. Facings, Penistone

FOR
Blacking, Plumbago (Ceylon), Core Gum, Part Powder, Facings, White Dust, Terra Flake, Talc, Ganister, and ALL Foundry Requisites.
Send P.C. for price and samples.
Good stocks kept.

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HIGH-CLASS PATTERNS and MODEL NON-FERROUS CASTINGS
WILL. 4371/2. (On Government Lists)

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Wanted
Scrap Zinc, Zinc Base Alloy Scrap & Turnings
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UP TO HIGHEST DIMENSIONS
Finest Workmanship. High Technical Assistance for Easy Foundry Production
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THE NEW FOUNDRY BONDING MATERIAL
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GROUND GANISTER
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● The Latest Core and Mould Wash for IRON CASTINGS ●

STEELMOL for STEEL and SPECIAL IRON CASTINGS

HIGH CARBON BLACKING · CEYLON PLUMBAGO
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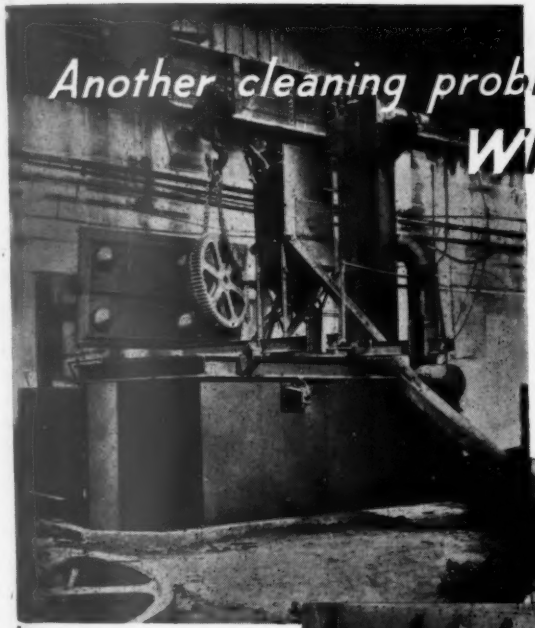
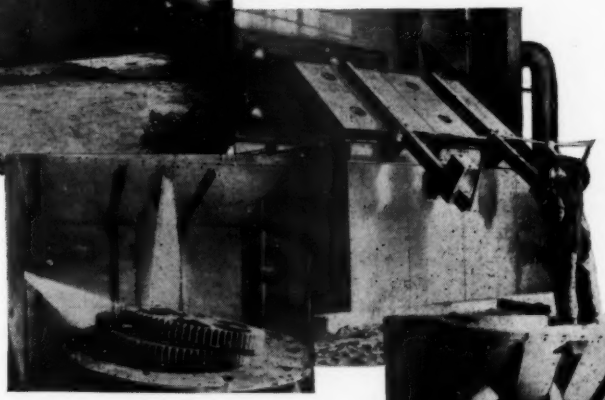
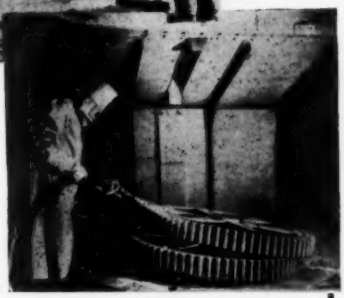
Another cleaning problem solved by a WHEELABRATOR



The Problem: To clean in a few minutes, large cored and intricate steel castings. *The Answer* A room with two Wheelabrator wheels, one throwing the abrasive vertically, the other horizontally, on to the castings which are readily lowered by the crane through the roof. Any hidden parts not perfectly clean are then touched up by a Sandblaster. *Result:* 100% efficiency.





1. Castings being lowered through roof (the near half of which is closed to give better view) on to the revolving table in the room.
2. The operator closes the counterbalanced roof without effort. Roof doors are sealed when closed; dust is exhausted at necessary points.
3. Castings being subjected to intensive automatic abrasion as the turntable revolves [under the streams of shot from the Wheelabrator wheels.
4. The Sandblaster in protective clothing and receiving clean air, then touches up the very few hidden parts not reached

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